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Hendrik Möller & Robert Graf, TU Munich

Advances in Automated MRI Processing for Population-Scale Musculoskeletal Research

Abstract. We present recent advances in automatic image processing pipelines designed for large-scale cohort studies, focusing on applications in the NAKO (German National Cohort) and back pain research. We first highlight our work on Image2Image translation methods, including denoising diffusion models and Pix2Pix networks, which enable missing sequences, correction of reconstruction errors in water-fat imaging (MAGO-SP), and MRI-to-CT translation for a correct bone segmentation accuracy. The second part will focus on segmentation, showcasing models such as SPINEPS and TotalVibeSegmentator and how we generate new ground truths for training. We will then turn to the analysis of anomalies in the spine — including variations in vertebral morphology*, stump ribs, and enumeration anomalies. Finally, we will present initial findings on spine morphology, and proton density fat fraction (PDFF) statistics across large population datasets, providing new insights into musculoskeletal health and disease patterns.

Speaker Bio. Hendrik Möller is a doctorate student in computer science at the University Hospital rechts der Isar at TUM (Department for Diagnostic and Intervenrional Neuroradiology). He works in an EU-funded project around the NAKO (transl. national cohort) dataset, a large MRI cohort representing the german population. He develops machine learning methods to label and segment these scans with a practical orientation. Before that, he finished his Master's in Robotics, Cognition, and Intelligence at the Technical University of Munich. Robert Graf is a PhD student affiliated with the Institute of Artificial Intelligence in Medicine at the Technical University of Munich (TUM) and the Deep-Spine group (https://deep-spine.de/). He works on Spine image translation, superresolution, registration, and analysis.

Time & Place.

Wednesday, May 21, 2025
13:00-14:00
Building O27, Room 441

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